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Playful Mobility Choices: Motivating informed mobility decision making by applying game mechanics

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Abstract

Motivating people to change their mobility behaviour patterns towards more sustainable forms of mobility is one of the major challenges regarding climate change and quality of life. Recently, an increasing amount of attempts to use gamification for triggering such behavioural changes can be observed. However, little is known about the actual impact of using game elements. This contribution describes a concept for systematically analysing the group-specific effects of different game mechanics on mobility decision processes (e.g. mode and route choice). Based on theoretical findings concerning player types and mobility styles we developed a framework for identifying effective game mechanics motivating users to explore mobility alternatives and take more informed and more sustainable mode or route choice decisions. The results will form the basis for implementing game mechanics in mobility information services motivating users to explore unfamiliar but more sustainable mobility options.

Keywords: transportation, mobility choices, gamification, game mechanics, social milieus.

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1. Introduction

Promoting active mobility of people is of paramount importance when it comes to tackling societal challenges such as health and quality of life and increasing sustainability in general. Therefore, much effort is taken in order to encourage people to use more sustainable forms of mobility and to change to a more energy efficient mobility behaviour. Common policy measures use incentives (rewards) and disincentives (penalties) as trigger mechanisms for initiating behavioural changes, but the expected persistent impact is often not achieved as people merely react to the given constraints while intrinsic motivation cannot be triggered.

In mobility research, the availability of comprehensive and accurate information about transport options and the consequences of using specific modes are reckoned to be one of the most important enablers of behavioural change. However, the provision of information alone is not sufficient to encourage people to change habitual behaviour, as there are different barriers hindering behavioural changes [1]. Usually, the selection of a specific route or mode of transport for a trip is based on habits and subjective experiences as well as assumptions or opinions regarding the perceived alternatives. Providing mobility-related information is necessary, but not sufficient for actually initiating behavioural changes: this can only be achieved if the communicated information appeals to the attitudes, values and motivators of the target group [2].

Recently, gamification approaches are increasingly used in order to motivate people by providing game design elements in non-game contexts [3]. But although findings show that gamification does produce positive

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effects and benefits, not all game mechanics work for all users and it stays questionable if the results of gamification are long-term or might merely be caused due to a novelty effect [4]. The context of the gamified activity, the motivation of the users and the nature of the gamified systems strongly impacts the effect of gamification; hence, it is necessary to systematically investigate the effectiveness of different game mechanics addressing the motivators of different people.

2. Related studies and knowledge gaps

In relation to mobility there are already a growing number of attempts for motivating behavioural changes by using game elements like incentives or rewards. However, empirical studies concerning the evaluation of different approaches and the actual effect of applying specific game mechanics are still scarce. A meta-study on the general us of gamification [4] revealed that there is evidence that gamification produces positive effects and benefits, but that it can also have unexpected and undesired consequences: e.g. negative side effects can be provoked, impacts are very user specific and limited to specific groups, and usually only some – not all – of the mechanics and motivational affordances worked in the studies reviewed. Moreover, most of the existing studies showed some significant shortcomings, as they only used small sample sizes, showed a lack of proper and validated psychometric measurements or control groups, and the timeframes used in the studies have usually been too short for drawing conclusions about potential long-term effects.

Currently, there are only a limited number of studies focusing on the evaluation of the impact of gamified applications for motivating behavioural changes in the mobility context, focusing on different aspects of mobility like commuters' behaviour, CO2 emissions of routing alternatives, changes of driving habits, or enhancing the mobility experience [5,6,7,8,9,10,11,12]. However, as the application of gamification in the field of mobility is still comparatively new, many of those studies are still ongoing and final conclusions are not yet published. In addition, most of the approaches also have to deal with limited sample sizes and timeframes, which make the results debateable. Some transport providers like car manufacturers or public transport operators have also started to use game mechanics for initiating behavioural changes or enhancing the user experience, but there are no evaluation reports available or existent, and so the actual impact of these measures is unknown (e.g. Chromaroma[†], Toyota Prius fuel gauge, Ford Smartgauge with EcoGuide[‡]).

Although the literature on the effects of gamification in mobility is somewhat limited, there are a few confirmed conclusions which can be identified based on the published findings:

- Gamification is a useful tool to provoke behaviour and aptitude change in the area of mobility behaviour change [4,6].
- In particular gamification can enrich the users' motivation and engagement in specific activities, but also in exploring new possibilities and options [4,5].
- When players engage within the game mechanics, behaviour other than intended can occur due to the dynamics set in motion through the game [5,11].
- The nature of the gamified systems strongly impacts the effect of the gamification [4].
- Therefore it is key to get a good sense of the users' motivation, but also of player styles and types [5].

Another conclusion from existing projects is that studies analysing the effect of game mechanics on user behaviour in real life mobility situations have to struggle with the fact that mobility behaviour is determined by a huge variety of different influence factors, and that changes in behaviour (or the lack of) may be caused by other factors than specific game mechanics. Hence, to translate transportation behaviour to metaphoric game elements appears to be a promising way to test the structure of a gamification system on the players [13].

3. Study framework

As part of the international research project 'Crossing Borders' we currently investigate the potentials of using type-related motivators and corresponding mechanics in order to influence mobility choices and motivate people to change to more sustainable forms of transport. The approach is based on the following assumptions and preconditions:

- Mobility behaviour is strongly determined by habits and the use of information about mobility alternatives. The provision of (more or better) information is however not sufficient for initiating behavioural changes if users are not willing or interested in gathering this information and stick to their habits.
- Mobility behaviour is also determined by different constraints (e.g. availability of transport modes, costs, time constraints, lack of familiarity with specific mobility services). Hence, measures aiming at altering behaviour may show no effect as specific barriers hinder a change in behaviour, even if a person would be willing to change.
- People have different behaviour patterns. This affects mobility behaviour as well as gaming behaviour and leads to the fact that measures are not equally effective for every person.

[†] http://www.chromaroma.com/

[‡] http://smartdesignworldwide.com/work/ford-smart-gauge/

Regarding these initial points, we focus on the investigation of the effectiveness of game mechanics for encouraging specific groups of people to acquire comprehensive information about available mobility options and take more informed and more sustainable mode choice decisions: "Decisions are not made in isolation; instead they are influenced by numerous noticed or unnoticed factors enforced by the environment where the decision is being made. […] if we properly design and incorporate small features or nudges in the choice making process, we can assist individuals to overcome cognitive biases while highlighting the better choices for them, without restricting their freedom of choice" [13, p.1505]. In order to analyse which groups react to specific mechanics and to assess which impact could be achieved concerning behavioural changes we base our approach on the theoretical concepts of player types as well as social milieus and their relation to mobility styles.

Player types

In game studies there is a fruitful discourse about player types that can be useful for the gamification discourse [9]. When individuals engage in playful settings they are driven by different motivations. There are different theoretical models that outline different characteristics of players. In general, the question arises what motives individuals and groups have to play. Answers to this question can be found in behaviour psychology and self-determination theory. Pink [14] differs between three general motivational factors: autonomy, mastery, and purpose. On the other hand, self-determination theory [15] posits three factors as well: autonomy, competence, and relatedness. Combining these two sources results in intrinsic motivation coming from four factors [16]: autonomy, mastery, relatedness, and purpose. Based on different motives to engage in multiplayer real-time virtual worlds (MUDs) four different player types have been described by Bartle in the late 1980s [17]. Starting from this typology, Marczewski [16] later attempted to build a classification of users for gamification purposes. He developed the concept further with focus on the specific setting of playing in non-games context (gamification). He compares 6 different players engaging in gamification:

- Socialisers are motivated by Relatedness. They want to interact with others and create social connections.
- Free Spirits are motivated by Autonomy. They want to create and explore.
- Achievers are motivated by Mastery. They are looking to learn new things and improve themselves. They want challenges to overcome.
- Philanthropists are motivated by Purpose and Meaning. This group are altruistic, wanting to give to other people and enrich the lives of others in some way with no expectation of reward.
- Disruptors are motivated by Change. In general they want to disrupt your system, either directly or through other users to force positive or negative change.
- Players are motivated by Rewards. They will do what is needed of them to collect rewards from a system. They are in it for themselves.

Usually, players are not strictly motivated by only one factor, but by a combination of some of the factors (e.g. mainly by Relatedness, but also to some extend by Rewards and Mastery). Analysing the effectiveness of mechanics related to different motivators can therefore provide the basis for selecting those mechanics which are able to reach the majority of users, as they will react to at least one of the implemented mechanics.

Social milieus

Recently, there have been several approaches considering social milieus in transportation-related studies [18]. Social milieus denote communities of values, which are on the one hand strengthened and reinforced by social relations and formed by ideological imprints and general trends (examples: Traditional Milieu, Modern Mainstream Milieu, Modern Performing Milieu, Sensation Oriented Milieu). First findings indicate that the inclusion of milieu-related attributes can provide more comprehensive insights into the determinants of mobility behaviour. Findings about the mobility-related preferences and aversions of specific milieu segments have for example been used for assessing the potential and acceptance of different services in rail traffic [19,20] (see Table 1).

A study on mobility styles for recreational purposes revealed six different types determined by mobility behaviour habits, lifestyle and social status [21]: "Disadvantaged" (basic education, low income, limited mobility options), "Modern-Exclusive" (professional orientation, discerning, interested in technology), "Fun-oriented" (individualistic fun, risk orientation, technology-oriented, reference to peer groups, young, educated), "Overburdened Family-oriented" (domestic and neighbourly orientation, family values, mainly females, insufficient demarcation of work, housework and leisure time), and "Traditional Domestic" (security, durability, nature, traditional values, reservations concerning modern technologies, above-average age).

Table 1. Mobility-related preferences and aversions of milieu segments [19,20].

Milieu segment	Preferences	Aversions
"Young" milieus (24 %)	spontaneity, intenseness, social networks, originality, instant fun	boring, inefficient, uninspired, narrow-minded, pre-planned
"Exalted" milieus (24 %)	comfortable, fast, private, nature-oriented, self-determined	exhausting, uncultured, unreasonable
"Mainstream" (27 %)	predictable, approved, respectable, accessible	insecure, unpredictable, threatening
"Traditional" milieus (25 %)	simple, community, familiar, regular, personal, humble, independent	impersonal, inefficient, exotic, incomprehensible

These findings provide basic information about the probability of behavioural changes within a group in case individuals are provided with group-related motivators. As some groups strongly lack the ability or willingness to change their behaviour (e.g. due to financial restrictions or strong aversions to specific transport services) the identification of high potential groups for initiating behaviour changes based on lifestyle and milieu characteristics can facilitate the development of effective group-specific solutions.

4. Methodology

Based on the knowledge concerning the motivators of player types and the values and attitudes of social milieus the current approach aims at investigating the potential of using game mechanics in relation to specific player types and social milieu groups. In order to avoid the influence of constraints determining the mode choice in real life situations, we use an abstract and metaphorical approach to mobility in the game and focus on the player types and their motivations to engage with particular mechanics. In addition we are using a virtual surrounding to get a better sense of basic motivation within playful settings. In particular, the current approach is focusing on the following research questions:

- How are player typologies impacting the preferences for game mechanics in the context of an abstract mobility game?
- What are the most effective mechanics – target group relations for initiating intrinsic motivation for taking informed decisions?
- Which motivators are correlating with which milieu-related values?

For the selection of relevant mechanics to be tested in the study, six "personas" (profiles of fictitious typical users) have been created based on socio-demographic characteristics, education, milieu, player type, mobility style, motivation to play, and potential impact of playing. To test the effectiveness of the selected game mechanics, a playful virtual context is currently developed that uses specific game mechanics and raises the awareness of virtual mobility choices and informed decisions of different travel qualities. The game itself will be a collection of several minigames (casual games following the example of Re-Mission 2[§]) in the form of "challenges" abstractly referencing mobility choices (i.e. moving dots with different characteristics). Starting from a comprehensive list of more than 40 game mechanics [22] we pre-selected 20 mechanics that relate to four player types which are relevant regarding the research focus and defined personas[**] (see Fig. 1). In order to avoid mutual influences of the impact of different mechanics implemented in one game we selected core mechanics (see Fig. 2) which can be evaluated more separately within the set of minigames; hence, influences aggravating the measurement of the effectiveness of single mechanics are limited.

Figure 1. Selected game mechanics matching player types (typology: see [16]).

[§] http://www.re-mission2.org/games/

[**] The "disruptor" is neglected as this type will try to change the system, and there is no need to select mechanics for the "player" as this type will be motivated by the game itself.

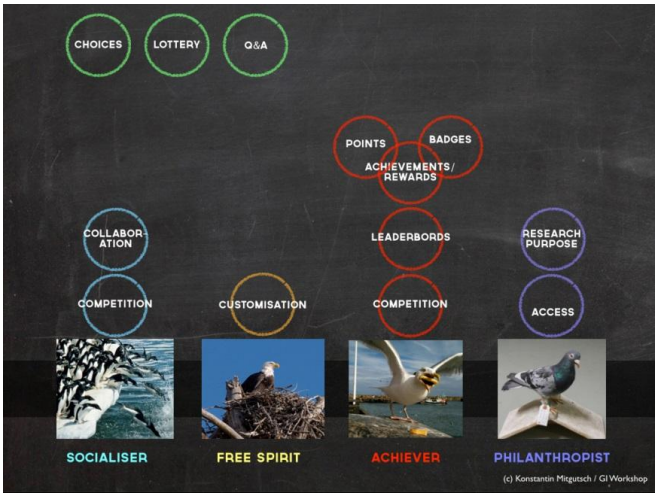

Figure 2. Selected mechanics for the minigames based on player types (typology: see [16]).

During the game the player has to navigate a dot with different characteristics (e.g. size, colour saturation) through a maze. Each link within the maze affects one of the dot's characteristics (e.g. growing or darkening the dot). The aim of the game is to find the most efficient path through the maze by considering the specific effects of the links on the dot and selecting the path having the least negative effects, i.e. taking the most informed decision for navigating the dot. The research question we follow in this experiment is which game mechanic motivates which type of person to intrinsically engage in this problem.

In order to evaluate these effects, we designed six different challenges which are variations of the same game but comprise different mechanics:

- Exploration
- Points and highscores
- Team competition
- Badges
- Team sharing
- Single competition

A minimum sample of 500 players will be invited to consecutively play the different challenges. For their participation in the study they will be provided with a incentives (choice of 5€ vouchers) and can participate in a lottery to win a tablet PC. Additionally, they can access further information about the research project. Alternating to the game challenges, the players are to complete questionnaires which allow allocating them to different player types, social milieus and mobility patterns. While playing the challenges, the system will track the players' behaviour (e.g. how many levels have been played, how much information has been collected), and after completing each challenge the participants will be asked for feedback (e.g. how much they liked the challenge). In addition, general motivations of the players to participate in the study will be investigated (interest in research purpose, lottery, etc.).

After data collection, the data will be analysed by clustering the effects of the different game mechanics used in the game and investigating which participants (i.e. which player types, which milieu types) were most responsive to the specific game mechanics. In this way, we aim at disclosing correlations between preferences for specific game mechanics and characteristics of different social groups.

5. Expected outcome and future work

Based on our evaluation we are intending to find how game mechanics, mobility choices, player types and social milieus are interrelated. The identified impact of specific mechanics will be used for recommendations concerning the application of game mechanics in non-game contexts like mobility information systems such as multi-modal routing services. The results will contribute to develop systems which motivate user groups to procure comprehensive information about different mobility options and change their habits towards more sustainable mobility behaviour.

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